U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-260 235

REPORT ON POLLUTION OF INTERSTATE WATERS OF WORM CREEK AND OF THE CUB AND BEAR RIVERS, IDAHO-UTAH

ROBERT A. TAFT SANITARY ENGINEERING CENTER
CINCINNATI, OHIO

JULY 1960

254017

Property of
Robert S. Kerr Water Research Center
Library

PB 260 235

Library

REPORT ON

POLLUTION OF INTERSTATE WATERS

of

WORM CREEK

and of the

CUB AND BEAR RIVERS

IDAHO - UTAH

U. S. Department of Health, Education & Welfare

Public Health Service

Robert A. Taft Sanitary Engineering Center

Cincinnati, Ohio

July 1960

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U. S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA. 22161

BIBLIOGRAPHIC DATA SHEET	1. Report No.	2.	3. Recipient's Accession No. PB-260 235
4. Title and Subtitle Report on Pollution of Interstate Waters of Worm Creek and of the Cob and Bear Rivers, Idaho-Utah.			5. Report Date Jul 60 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio.			10. Project/Task/Work Unit No. 11. Contract/Grant No.
12. Sponsoring Organization Name and Address			13. Type of Report & Period Covered 14.

15. Supplementary Notes

16. Abstracts

The Utah Water Pollution Control Board studied streams of the Bear River Basin during July 1958 through September 1959. Selected data from this study are used to supplement data from a 1955 study of water quality. Data on water quality in Utah in the river reaches are compared with standards for certain constituents covered by the preliminary classifications established by the Board. Cub River, Worm Creek, and Malad River are involved.

17. Key Words and Document Analysis. 17a. Descriptors

17b. Identifiers/Open-Ended Terms

Tables(Data)
*Water quality
*Water pollution sampling
Bear River
Utah
Cub River
Worm Creek
Malad River
Wyoming
Waste disposal
Industrial wastes
Water pollution standards

17c. COSATI Field/Group 13B

18. Availability Statement	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 35
	20. Security Class (This Page UNCLASSIFIED	22. Price

FORM NTIS-35 (REV. 10-73) ENDORSED BY ANSI AND UNESCO. THIS FORM MAY BE REPRODUCED USCOMM-DC 8265-P74

POLLUTION OF INTERSTATE WATERS

OF THE BEAR RIVER

IDAHO - UTAH - WYOMING

INTRODUCTION

During the November-December, 1955, study the seasonally operated Franklin County Sugar Company plant at Whitney, Idaho, and the Amalgamated Sugar Company plant at Lewiston, Utah, were in operation. The California Packing Company plants at Franklin, Idaho, and Smithfield, Utah, were closed for the winter.

Since that time additional information on effects of wastes on water quality has been obtained. The Utah Water Pollution Control Board made a study of streams of the Bear River Basin in Utah during the period July, 1958 through September, 1959. Selected data from this study have been used to supplement the evaluation of water quality data which was presented at the first session.

At the time of the first session the Utah Water Pollution Control Board had not classified the streams that are involved. Since then the Board has taken preliminary action to classify the streams, and it is anticipated that final action on classification will be taken subsequent to this session. In this statement, data on water quality in Utah in the river reaches under consideration are compared with standards for certain constituents covered by the preliminary classifications established by the Board. The preliminary classifications are:

BEAR RIVER

State Line to Cutler Dam — Class C

Below Cutler Dam to Malad River	Class C_1
Upper River in vicinity of Wyoming-Utah State Line	Class C

CUB RIVER

State Line to Mouth	Class D

WORM CREEK

State Line to Mouth	Class D

MALAD RIVER

State Line to Garland, Utah	Class C_1

THE AREA

The principal river reaches involved are shown in Figure 1. These are:

1. The Bear River from a point west of Preston, Idaho, to just below Cutler Reservoir in Utah.

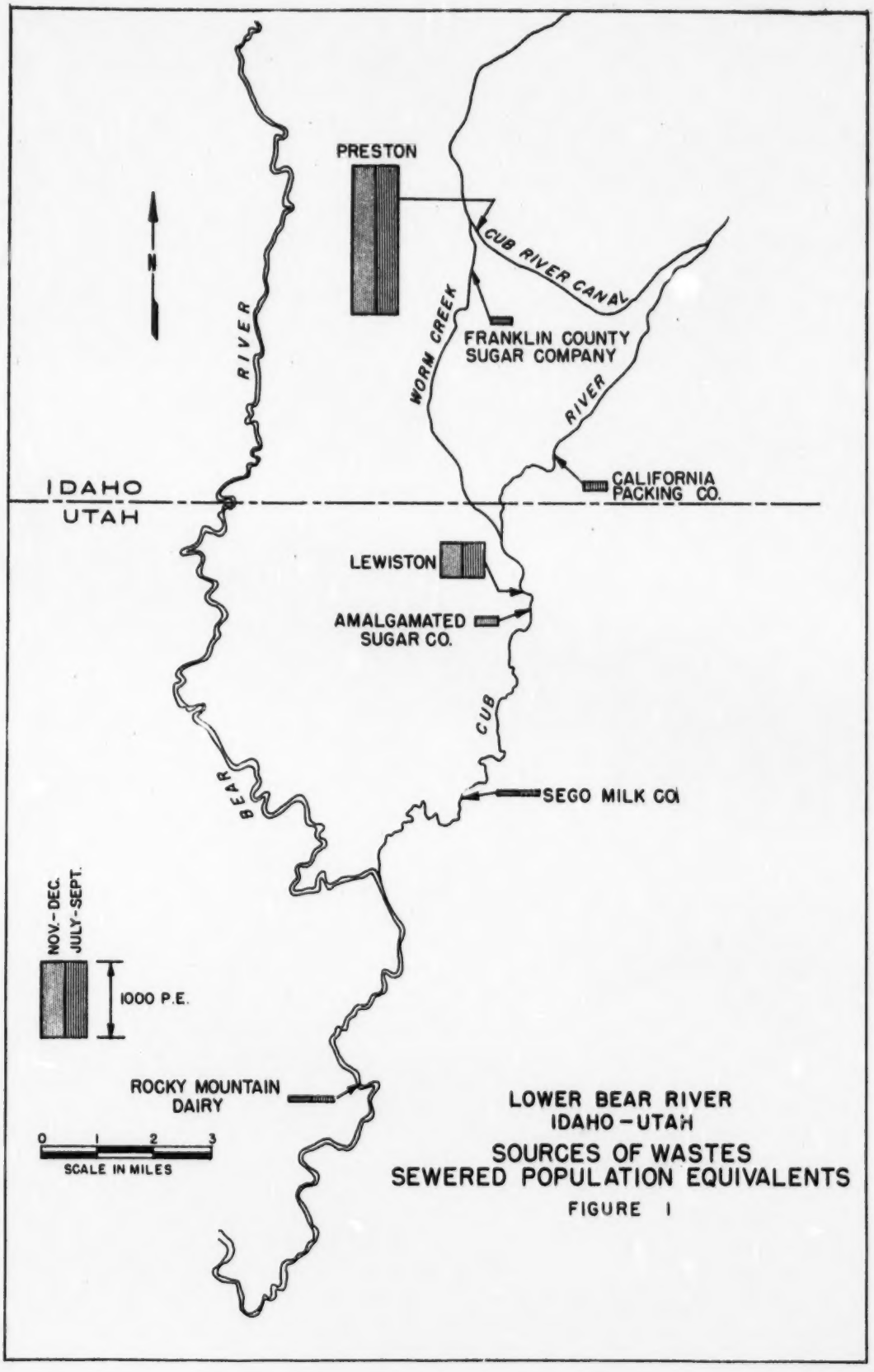
2. The Cub River from a point southwest of Franklin, Idaho, to its junction with the Bear River southwest of Richmond, Utah.

3. Worm Creek from a point southeast of Preston, Idaho, to its junction with the Cub River just south of the Idaho-Utah state line.

Both domestic sewage and industrial wastes are discharged to the stream reaches involved. The principal industrial wastes are produced in the manufacture of beet sugar, dairy products, and vegetable processing.

Uses of the waters of these stream reaches include: irrigation and stock-watering; recreation, including fishing; and aquatic life and wildlife habitat.

In addition to the principal stream reaches discussed above, consideration has been given to a portion of the Upper Bear River from above Evanston, Wyoming, to the Utah state line. In this stream reach the only source of pollution is Evanston, from which treated sewage and industrial wastes are discharged to the Bear River.



LOWER BEAR RIVER
IDAHO – UTAH

SOURCES OF WASTES
SEWERED POPULATION EQUIVALENTS

FIGURE 1

SOURCES OF WASTES

Characteristics of wastes discharged to the streams of the Lower Bear River Basin in the vicinity of the Idaho-Utah state line are listed in Table 1. Because of the seasonal nature of the beet sugar and vegetable canning operations, the waste characteristics are given for two periods of the year; November-December, and July through September. The two periods were selected to coincide with both seasonal industrial operations and the stream data used for evaluation of water quality. The beet sugar plants operate during the November-December period, and the canning plants during the July through September period. Municipal sewage and milk wastes are discharged during both periods.

SEWERED POPULATION EQUIVALENTS

Figure 1 shows the sources of bacterial contamination in terms of sewered population equivalents discharged to the streams, during the November-December and the July through September periods. The term "sewered population equivalents" rather than sewered population is used to cover the estimated 50 percent reduction in bacterial contamination accomplished by the Preston, Idaho, primary sewage treatment plant, which serves a population of 4,000. Even with this allowance, the Preston sewage treatment plant effluent, with a sewered population equivalent of 2,000, accounts for about 70 percent of the sewage bacterial contamination of the streams of the area. Untreated sewage from Lewiston, Utah, is the second largest source, with about 17 percent of the total. The remainder of the sewage bacterial contamination has its source in untreated sewage from the employees of industrial plants. The slight difference between the 2,812 sewered population equivalent for November-December, and that of

TABLE 1

Lower Bear River, Idaho-Utah
Characteristics of Wastes Discharged to Streams

Source	Sewered PE				BOD PE				Susp.Solids PE			
	Nov.-Dec.		July-Sept.		Nov.-Dec.		July-Sept.		Nov.-Dec.		July-Sept.	
	PE	%	PE	%	PE	%	PE	%	PE	%	PE	%
Preston, Idaho Sewg.	2,000	71.13	2,000	67.64	3,000	0.49	3,000	4.32	2,600	0.14	2,600	18.84
Whitney, Idaho												
Franklin Co.Sugar Co.	85	3.02	-	-	258,000	42.03	-	-	1,258,000	66.62	-	-
Franklin, Idaho												
Calif. Packing Co.	*	*	150	5.07	*	*	17,800	25.65	*	*	*	*
Lewiston, Utah, Sewg.	500	17.78	500	16.91	500	0.08	500	0.72	500	0.03	500	3.62
Amalg. Sugar Co.	120	4.27	-	-	346,000	56.30			621,000	32.89	-	-
Richmond, Utah												
Sego Milk Co.	42	1.49	42	1.42	600	0.10	600	0.86	1,600	0.08	1,600	11.60
Smithfield, Utah												
Rky.Mtn.Dry.Prod.Co.	65	2.31	65	2.20	6,150	1.00	12,300	17.73	4,550	0.24	9,100	65.94
Cal. Pack. Co.	-	-	200	6.76	-	-	35,200	50.72	-	-	*	*
	2,812		2,957		614,250		69,400		1,888,250		13,800	

* No value available.

These data are depicted in Figures 1 through 3.

2,957 for July-September is attributable to the seasonal operation of beet sugar and vegetable canning plants, with the accompanying variations in plant employees contributing sewage.

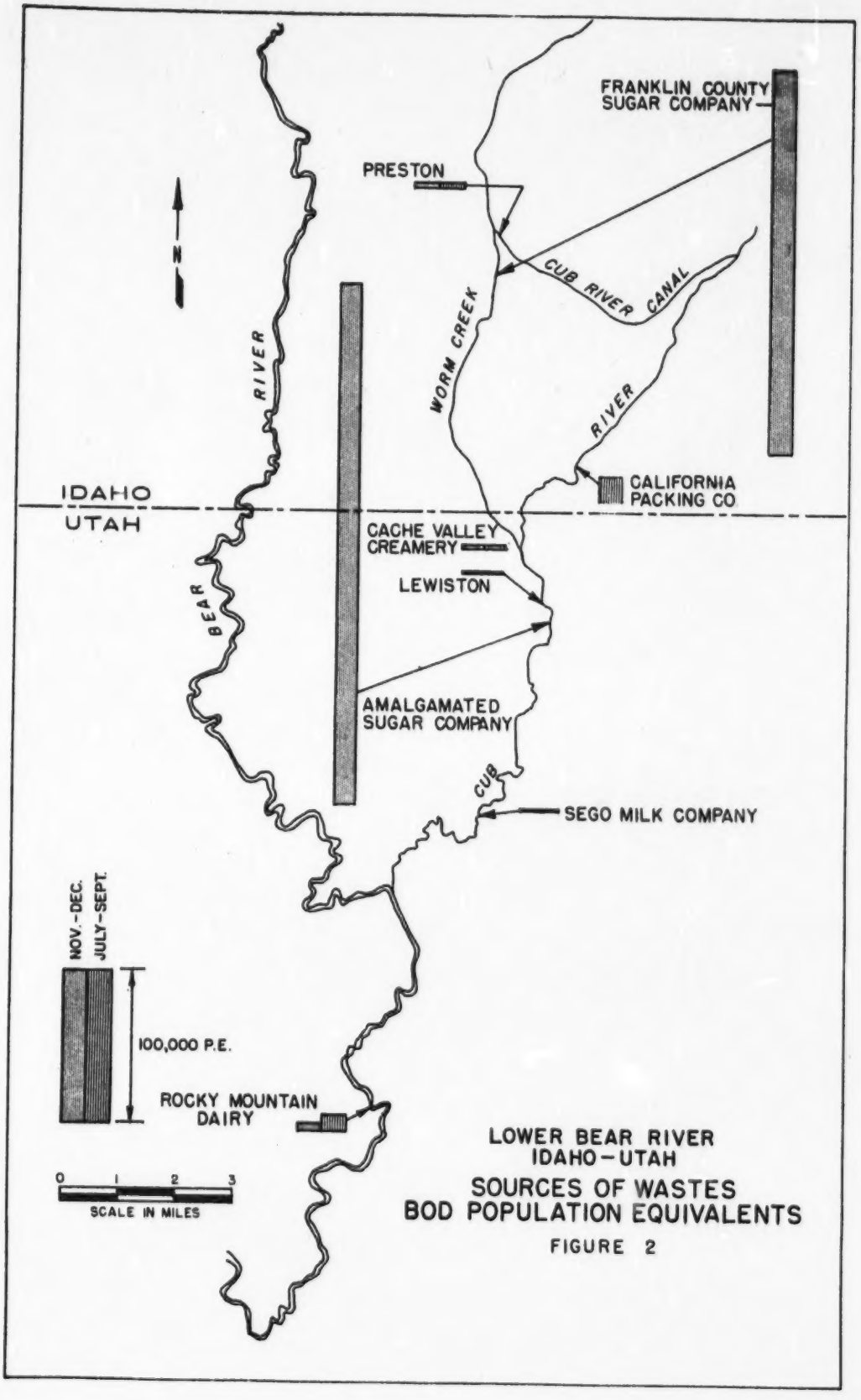
B.O.D. POPULATION EQUIVALENTS

The B.O.D. population equivalents of the sources of organic wastes are shown in Figure 2. The high organic load reflected by a total PE of 614,250 during November-December is the result of the sugar beet plant operations. Of this 258,000 PE, or 42 percent of the total, are discharged from the Franklin County Sugar Company plant, at Whitney, Idaho, and 346,000 PE or 56.3 percent are from the Amalgamated Sugar Company plant at Lewiston, Utah. The California Packing Company at Franklin, Idaho, is reported recently to have started processing cabbage during winter, and now contributes to the organic pollution in winter. No quantitative data are available, however, on this source of waste during winter. The Rocky Mountain Dairy Products Company accounts for 6,150 PE, or 1.0 percent of the total; Preston sewage for 3,000 PE, or about 0.5 percent; Sego Milk Company at Richmond, Utah, contributes 600 PE, or 0.1 percent of the total; and sewage from Lewiston accounts for 500 PE, or a little less than 0.1 percent of the total.

During July-September the total PE is 69,400, of which the California Packing Company at Smithfield, Utah, contributes 35,200 or about one-half of the total. This company's plant at Franklin, Idaho, adds 17,800 or about one-fourth of the total. The Rocky Mountain Dairy Products Company accounts for 12,300 PE, or nearly one-fifth of the total. The PE of wastes from Preston, Sego Milk Company, and Lewiston remain the same as in November-December, but their percentages of the total increase, because of the lower July-September total, to about 4.3, 0.9 and 0.7, % respectively.

SUSPENDED SOLIDS POPULATION EQUIVALENTS

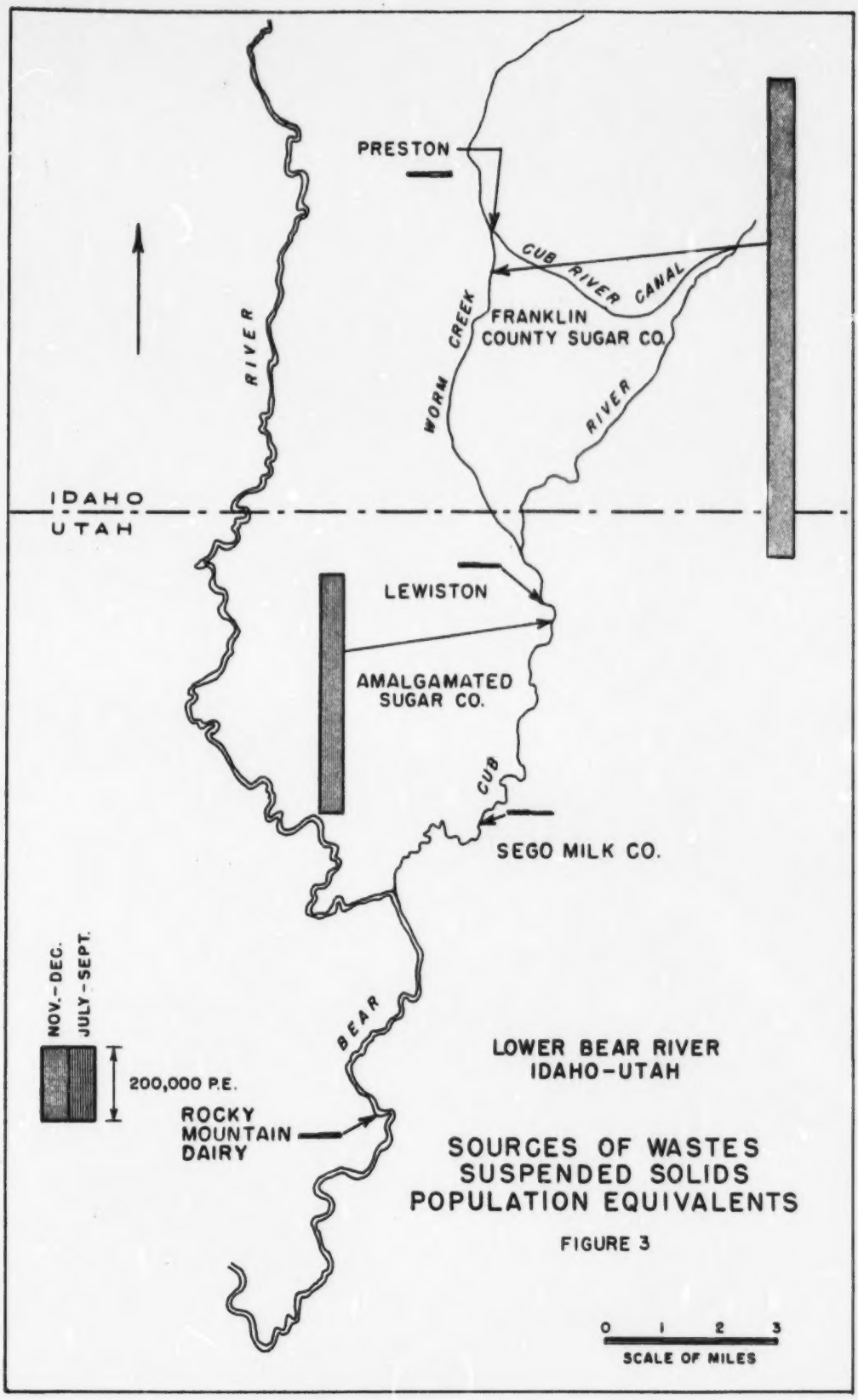
Figure 3 depicts the suspended solids from the sources of wastes. The total PE from all sources in November-December is



LOWER BEAR RIVER
IDAHO – UTAH

SOURCES OF WASTES
BOD POPULATION EQUIVALENTS

FIGURE 2


PRESTON
CUB RIVER CANAL
WORM CREEK
FRANKLIN COUNTY SUGAR CO.
RIVER
RIVER
IDAHO
UTAH
LEWISTON
AMALGAMATED SUGAR CO.
CUB
SEGO MILK CO.
NOV.-DEC.
JULY-SEPT.
200,000 P.E.
ROCKY MOUNTAIN DAIRY
BEAR
LOWER BEAR RIVER
IDAHO-UTAH
SOURCES OF WASTES
SUSPENDED SOLIDS
POPULATION EQUIVALENTS
FIGURE 3
0 1 2 3
SCALE OF MILES

1,888,000, of which the Franklin County Sugar Company contributes 1,258,000, or a little less than two-thirds of the total, and the Amalgamated Sugar Company contributes almost one-third of the total. The other four sources, Preston and Lewiston sewage, and the Sego Milk Company and Rocky Mountain Dairy Products plants combined, produce one-half of one percent of the total during November-December. Here again, data are not available on the winter contribution of the California Packing Company cabbage processing operation at Franklin, Idaho.

During the July-September period the suspended solids PE from sources of wastes on which data are available drops to 13,800. Of this the Rocky Mountain Dairy Products Company is the largest contributor with 9,100 PE or 66 percent of the total. Preston sewage accounts for 18.8 percent, Sego Milk Company for 11.6 percent, and Lewiston sewage for 3.6 percent. Data are not available for the two California Packing Company plants.

RESULTS OF SURVEYS

Mean values for coliform bacteria, B.O.D., and suspended solids found in the streams during November-December, 1955, while the beet sugar plants were in operation, are given in Table 2. This table also includes mean values for coliform bacteria and B.O.D. for July through September, 1959. Suspended solids were not determined in the streams during the latter survey, and all sampling was limited to the portions of the stream reaches that lie in Utah.

Figures 4 through 7 show the stream data on coliform bacteria and B.O.D. for the two periods as bars, proportioned to the concentrations of the constituents. These charts include, for comparison, bars representing the standards for coliform bacteria and for B.O.D. in Utah.

COLIFORM BACTERIA

The basic standard for the MPN of coliform bacteria for Classes C, C_1, and D waters is an average of 5,000 per 100 ml.

Figure 4 shows the median coliform MPN for the November-December period. On Worm Creek above all known sources of sewage pollution the coliform MPN was 15,000 per 100 ml. On the Cub River Canal above all known sources of sewage pollution the coliform MPN was 2,300 per 100 ml.

Preston, Idaho, sewage, from the town's primary treatment plant, is discharged to the Cub River Canal a few feet above the canal's confluence with Worm Creek. The first station on Worm Creek below the entrance of Preston sewage yielded a median MPN of 4,500 per 100 ml. This does not reflect the full effect of the sewage, since the sampling station was too close below the point at which sewage entered to allow time for the complete multiplication of bacteria in the stream.

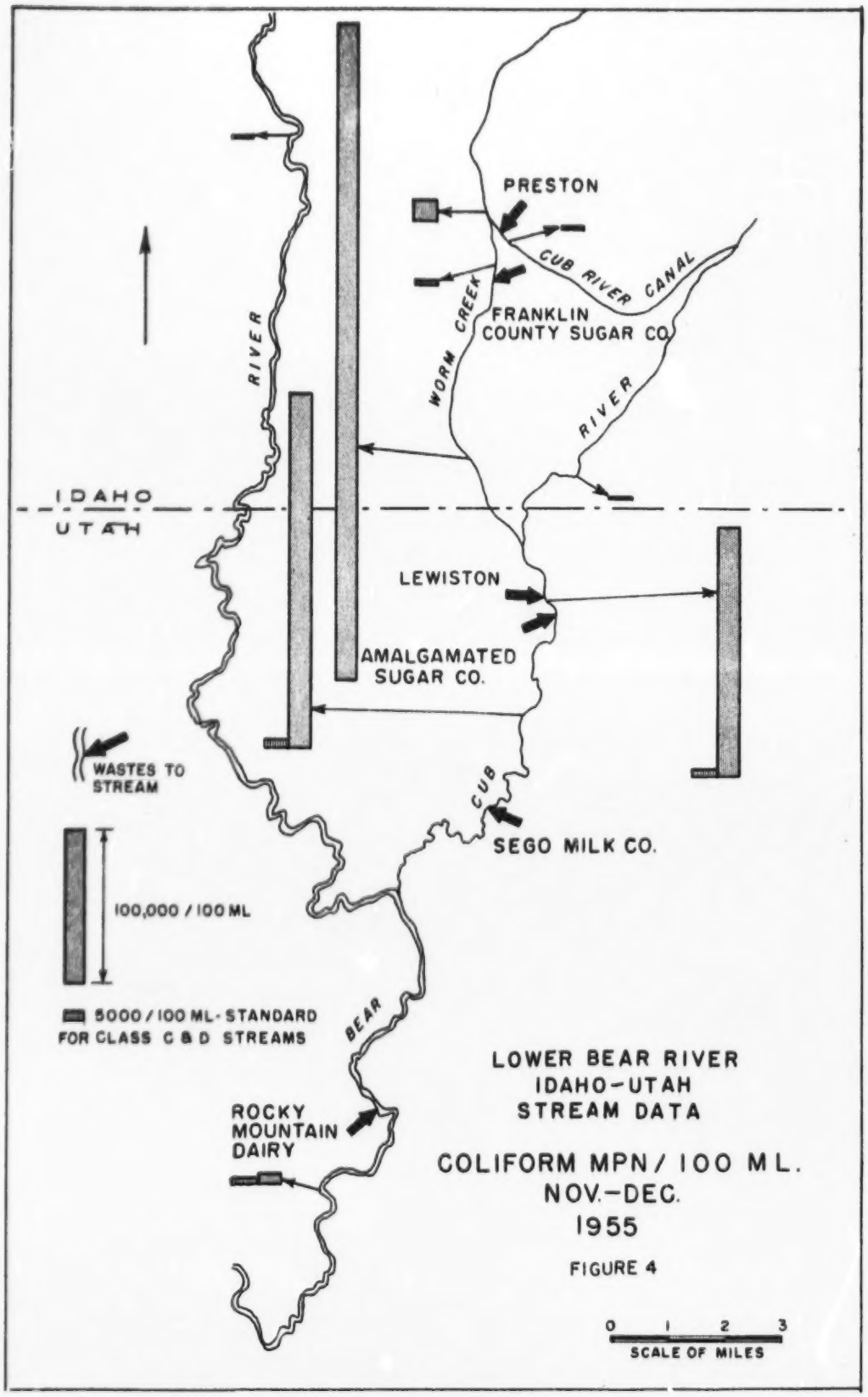
TABLE 2

Lower Bear River, Idaho-Utah
Results of Stream Analyses

Stream	Station USPHS (1)	Station UWPCB (2)		November - December Flow cfs	November - December Coliform MPN/100ml.	November - December BOD mg/l.	November - December Sus.Sol. mg/l.	July - September Flow cfs	July - September Coliform MPN/100ml.	July - September BOD mg/l.
Worm Creek	H		Above Preston, Idaho	3.1	15,000	2.21	114			
Cub River Canal	I		" Preston Sewage	13.4	2,300	0.72	7			
Worm Creek	J		Below Preston&CubR.Canal	10.1	4,300	2.81	40.1			
" "	K		" Franklin Co.Sug.Co. & Above State Line	20.0	430,000	264.00	543.0			
Cub River	L		Above State Line - Below California Packing Co.	9.6	330	0.8	9.2			
" "	M	16	Below State Line - Above Amalgamated Sugar Co.	32.9	163,000	162.	111.	7	6600	5.5
" "	N	22	Below Amalgamated Sugar	56.2	230,000	309.	24.2	15	1020	2.45
" "		C30.1	Below Sego Milk Co.					17	2300	-
" "		30	Above Mouth					19	3300	2.95
Bear River	G		Above State Line	316	93	1.20	20.7			
" "		13	Below State Line					591	930	2.3
" "		B32	Above Cub River						930	
" "		B23	Below Cub River & Rocky Mountain Dairy					611	2,300	3.5
" "	F	23	Below Cub River & Rocky Mountain Dairy	723	6,800	9.91	49.3			
" "	D	25	Below Cutler Reservoir	1170	9,300	8.90	7.6	157	330	2.4

(1) Station designations used in PHS 1955 Study

(2) Station designations used in UWPCB 1959 Study


PRESTON
CUB RIVER CANAL
WORM CREEK
FRANKLIN COUNTY SUGAR CO.
RIVER
RIVER
IDAHO
UTAH
LEWISTON
AMALGAMATED SUGAR CO.
WASTES TO STREAM
CUB
SEGO MILK CO.
100,000 / 100 ML
5000 / 100 ML - STANDARD FOR CLASS C & D STREAMS
BEAR
ROCKY MOUNTAIN DAIRY
LOWER BEAR RIVER
IDAHO-UTAH
STREAM DATA
COLIFORM MPN / 100 ML.
NOV.-DEC.
1955
FIGURE 4
0 1 2 3
SCALE OF MILES

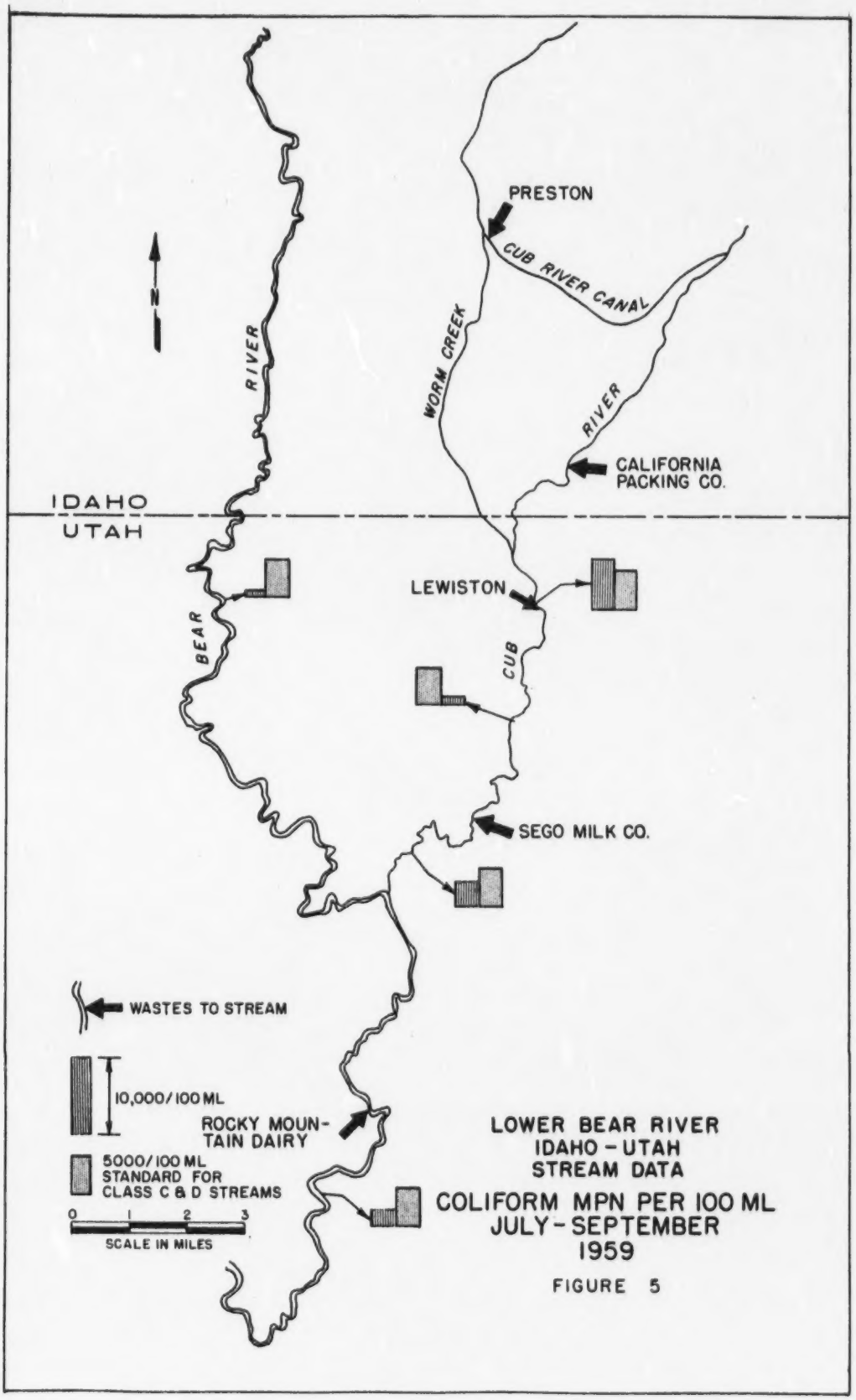
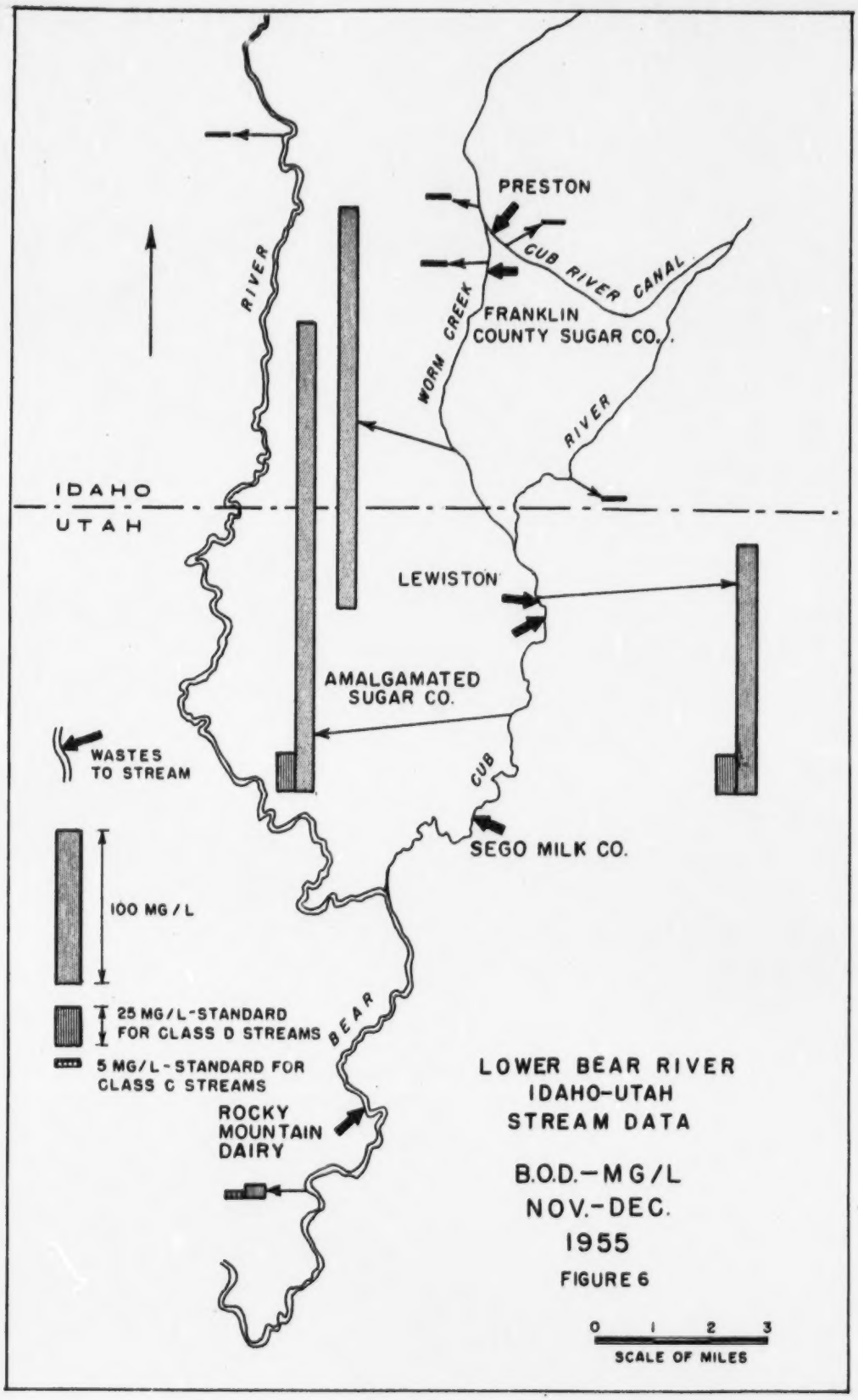
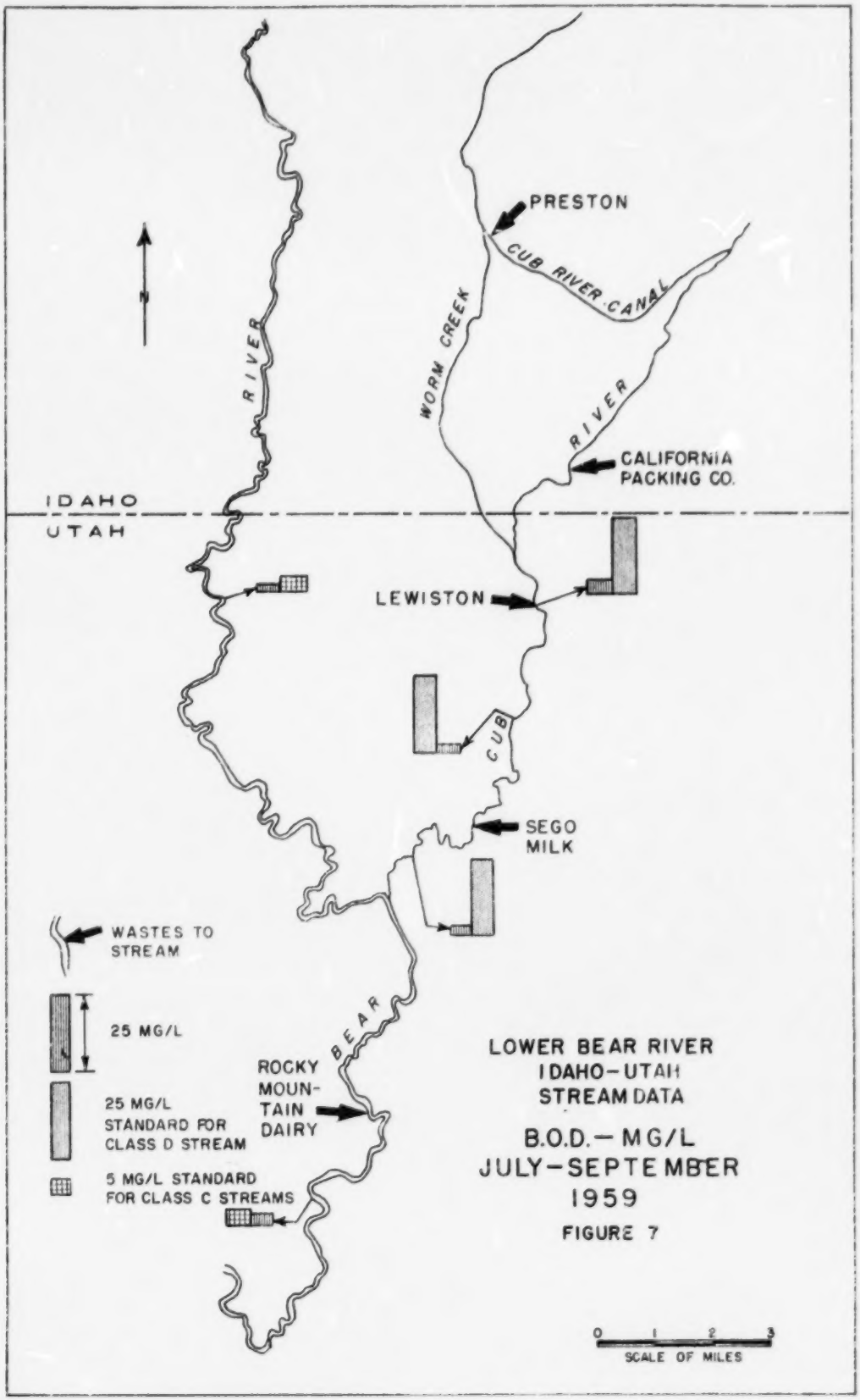

PRESTON
CUB RIVER CANAL
WORM CREEK
RIVER
RIVER
CALIFORNIA PACKING CO.
IDAHO
UTAH
LEWISTON
BEAR
CUB
SEGO MILK CO.
WASTES TO STREAM
10,000/100 ML
ROCKY MOUNTAIN DAIRY
5000/100 ML STANDARD FOR CLASS C & D STREAMS
0 1 2 3
SCALE IN MILES
LOWER BEAR RIVER
IDAHO - UTAH
STREAM DATA
COLIFORM MPN PER 100 ML
JULY - SEPTEMBER
1959

FIGURE 5


PRESTON
CUB RIVER CANAL
WORM CREEK
FRANKLIN
COUNTY SUGAR CO.
RIVER
RIVER
IDAHO
UTAH
LEWISTON
AMALGAMATED
SUGAR CO.
WASTES
TO STREAM
CUB
SEGO MILK CO.
100 MG/L
25 MG/L-STANDARD
FOR CLASS D STREAMS
5 MG/L-STANDARD FOR
CLASS C STREAMS
BEAR
ROCKY
MOUNTAIN
DAIRY
LOWER BEAR RIVER
IDAHO-UTAH
STREAM DATA
B.O.D.-MG/L
NOV.-DEC.
1955
FIGURE 6
0 1 2 3
SCALE OF MILES


PRESTON
CUB RIVER CANAL
WORM CREEK
RIVER
RIVER
CALIFORNIA PACKING CO.
IDAHO
UTAH
LEWISTON
CUB
SEGO MILK
WASTES TO STREAM
25 MG/L
25 MG/L STANDARD FOR CLASS D STREAM
5 MG/L STANDARD FOR CLASS C STREAMS
ROCKY MOUNTAIN DAIRY
BEAR
LOWER BEAR RIVER
IDAHO-UTAH
STREAM DATA
B.O.D. - MG/L
JULY-SEPTEMBER
1959
FIGURE 7
0 1 2 3
SCALE OF MILES

At the next station downstream on Worm Creek, which is below the waste discharge of the Franklin County Sugar Company, the MPN was 430,000 per 100 ml. Although the beet sugar wastes may have contributed a portion of the coliform bacteria at this station, the total coliforms actually were very close to the total that would be expected from the treated sewage of Preston plus the raw sewage from the employees of the Franklin County Sugar Company plant.

Worm Creek joins Cub River a short distance below the Idaho-Utah state line. On the Cub River in Idaho a short distance above the state line the coliform MPN was 330 per 100 ml.

On the Cub River in Utah, below its confluence with Worm Creek, the MPN was 163,000 per 100 ml., or 33 times the standard for Class D streams.

At the next downstream station on the Cub River, below the entrance of the Amalgamated Sugar Company wastes, the MPN increased to 230,000 per 100 ml., or 46 times the standard. Consideration of the total numbers of coliform bacteria at this station indicates that the Amalgamated wastes contributed an important portion of the bacteria, since the total cannot be accounted for by upstream sewage alone. A few miles below this station the Cub River receives wastes from the Sego Milk Company, and in another few miles the Cub joins Bear River.

On the Bear River in Idaho, at a point west of Preston, the MPN was 93 per 100 ml. Several miles below the Idaho-Utah state line the Cub River joins the Bear. Although there was no sampling station immediately below the confluence of these two rivers, it is estimated that the bacterial contamination carried by the Cub River increased the MPN of the Bear River by 10,000 to 15,000 per 100 ml., or 2 to 3 times the standard.

The next station downstream on the Bear River was below the Rocky Mountain Dairy Products Company plant. At this station the MPN was 6,800 per 100 ml., which is 36 percent above the standard. Sewage from the employees of the dairy probably did not account for more than 5 percent of the bacteria at this station.

The final station on the Bear River, just below Cutler Reservoir, does not appear on this chart. At this station the MPN was 9,300 per 100 ml., or nearly twice the standard for Class C_1 waters.

The coliform bacteria found during July-September, 1959, are shown on Figure 5. As noted previously, no samples were collected in Idaho during this period.

In Utah the median MPN at one station exceeded the standard during this period. This was on the Cub River below the confluence with Worm Creek, where the MPN was 6,600 per 100 ml., or 33 percent greater than the standard. This reflects the effects of sewage from Preston and the employees of the California Packing Company at Franklin.

There are requirements of the coliform standards for Class D waters other than the simple average of 5,000 per 100 ml. These other requirements are based on the distribution of coliform results within a set of values. The standards state that not more than 20 percent of the samples collected during any month shall exceed 5,000 per 100 ml., and not more than 5 percent shall exceed 20,000 per 100 ml. These requirements were exceeded at the station on the Cub River below the entrance of Worm Creek, and also at the station on the Cub near its mouth, below the Sego Milk Company. Here 33.3 percent of the MPN values during July-September exceeded 5,000 per 100 ml., and 16.7 percent exceeded 20,000 per 100 ml. The requirements also were exceeded on the Bear River below the confluence with the Cub, and below Rocky Mountain Dairy Products Company, and the California Packing Company at Smithfield, Utah, where 33.3 percent of the MPN values exceeded 5,000 per 100 ml., and 16.7 percent exceeded 20,000 per ml.

B.O.D. and Dissolved Oxygen

Figure 6 depicts the B.O.D. results in the streams during November-December. The basic B.O.D. standard for Classes C and C_1 waters is an average of 5 mg. per liter, and for Class D waters is an average of 25 mg. per liter.

On Worm Creek and the Cub River Canal above the entrance of Preston sewage the average B.O.D. was 2.21 and 0.72 mg. per liter, respectively. On Worm Creek below the Preston sewage discharge the B.O.D. was 2.81 mg. per liter. Below the Franklin County Sugar Company, but above the Idaho-Utah state line the B.O.D. rose to 264 mg. per liter. On the Cub River above the state line the B.O.D. was 0.8 mg. per liter.

After the Cub received the flow from Worm Creek, but above the Amalgamated Sugar Company in Utah, the B.O.D. was 162 mg. per liter, or 6.5 times the Utah standard of 25 mg. per liter for a Class D stream. Below the Amalgamated Sugar Company the B.O.D. of the Cub rose to 309 mg. per liter, or 12.4 times the 25 mg. per liter standard.

The Bear River in Idaho had a B.O.D. of 1.20 mg. per liter. After receiving the flow of the Cub River, and below the Rocky Mountain Dairy, and California Packing Company at Smithfield, Utah, the B.O.D. of the Bear was 9.91 mg. per liter, or nearly twice the standard of 5 mg. per liter for a Class C stream. Below Cutler Reservoir the B.O.D. was 8.90 mg. per liter, which also is nearly twice the standard.

Figure 7 shows the B.O.D. results for July-September, 1959. None of the average B.O.D. values exceeded the standards during this period, the highest value being 5.5 mg. per liter on the Cub River just below the Idaho-Utah state line, and below Worm Creek and the California Packing Company at Franklin, Idaho. Although this did not exceed the B.O.D. standard it should be noted that the D.O. at this station averaged only 2.1 mg. per liter, or 26 percent of saturation. During this period one D.O. value was as low as 0.5 mg. per liter, and 3 values ranged between 1.1 and 1.5 mg. per liter. While no quantitative D.O. limits are included in the Utah standards, the low D.O. values found indicate a condition which at times may deteriorate below even the Class E requirement that no nuisance resulting from a discharge of wastes shall be permitted. During periods of minimum stream flow it is very probable that an odor nuisance occurs in the vicinity of this station on the Cub River.

Low D.O. values occurred at some stations during November-December, also. Worm Creek below the Franklin County Sugar Company, but above the state line had an average D.O.

of 3.18 mg. per liter, with two individual values less than 0.1 mg. per liter. The Cub River below the mouth of Worm Creek and below the state line averaged 3.60 mg. per liter, with one value of zero, and two others less than 1.0 mg. per liter. Cub River below the Amalgamated Sugar Company averaged 3.83 mg. per liter, with 3 individual values near 1.5 mg. per liter.

SUSPENDED SOLIDS

The Utah standards for Classes C, C_1, and D waters require that no wastes shall be discharged that result in suspended solids which are readily visible or appreciably change the color of the receiving streams.

Suspended solids in the streams were determined during the November-December study, only.

On Worm Creek and the Cub River Canal above the entrance of Preston sewage the suspended solids averaged 114 and 7.0 mg. per liter, respectively. The high value on Worm Creek probably resulted from natural sources of silt.

On Worm Creek below the Cub River Canal, but above the Franklin County Sugar Company, suspended solids averaged 40.1 mg. per liter. Below the sugar plant, but above the state line, the average increased to 543 mg. per liter.

Suspended solids on Cub River above the state line and above Worm Creek averaged 9.2 mg. per liter. Below Worm Creek and the state line, but above the Amalgamated Sugar Company, the average was 111 mg. per liter. Below the Amalgamated plant average suspended solids decreased to 24.2 mg. per liter, despite the 62 tons per day of suspended solids discharged from the Amalgamated plant. Based on stream flow at this station, and in the absence of any sedimentation in the stream, the plant should have added 407 mg. per liter to the 111 mg. per liter in the Cub above the plant for a total of 518 mg. per liter.

The Bear River in Idaho had an average of 20.7 mg. per liter of suspended solids. Below the Cub River and the Sego Milk and Rocky Mountain Dairy Products companies, the average suspended solids increased to 49.3 mg. per liter. Below Cutler Reservoir the average dropped to 7.6 mg. per liter as a result of sedimentation in the reservoir.

FIELD OBSERVATIONS

Visual observations of the effects of pollution on water conditions have been made on several occasions. The most recent was on November 16, 1959.

Worm Creek and the Cub River Canal above the Preston sewage discharge were clear, with no visual evidence of pollution. Immediately below the confluence of these two streams, the effects of Preston sewage were visible in the form of grey to light brown slime growths on rocks in Worm Creek. Farther downstream on Worm Creek, but above the Franklin County Sugar Company, no visual evidence of pollution was detected. About one mile below the sugar plant, Worm Creek was highly turbid and brown. No biological growth of any kind was detected. Still farther downstream, about one mile above the Idaho-Utah state line, the creek was dark brown, and the odor of beet sugar wastes, resembling the odor of molasses, was very noticeable.

On the Cub River, near Franklin, Idaho, and above the California Packing Company, there were no visual evidences of pollution. Patches of green and brownish algae attached to rocks appeared typical of an unpolluted stream. The Packing Company plant was processing cabbage, and in the Cub River below the plant there were filaments of biological slimes, attached to submerged branches and debris, which are typical of streams polluted by organic wastes. Deposits of a fine, white material were noted.

Farther downstream on the Cub River, in Utah, and below Worm Creek but above the Amalgamated Sugar Company, the water was dark brown with suspended particles. The water was several feet deep here, which was in a small impoundment. Attached biological slime filaments were short, apparently because of the very low velocity of the impounded water. With higher velocities the slimes probably would have developed into long filaments.

Below the Amalgamated Sugar Company plant the water still was dark with suspended solids particles, though it appeared somewhat clearer than in the deeper water observed just above the plant. There was a profusion of both long attached filaments and floating detached clumps of biological slimes.

The Bear River was observed at two points in Idaho above the Cub River. At neither point was there visual evidence of pollution. Below the Cub River, and the Rocky Mountain Dairy Products Company, west of Smithfield, Utah, there were both floating patches of biological forms, and long attached filaments of biological slimes on submerged surfaces along the side of the Bear River on which the Cub River enters. The tops of the floating patches were greenish, and the bases were dark brown to black, which is typical of algae that grows on the surface of organic sludge deposits, detaches due to decay, and floats downstream.

Below the Cutler Reservoir the Bear River was clear, with no visual evidence of pollution.

BIOLOGICAL INVESTIGATIONS

Biological forms in the Bear and Cub Rivers and in Worm Creek were investigated in August and November, 1954. The principal findings during these two periods are summarized below.

PLANKTON

During August, plankton samples were collected at two stations on the Bear River, one in Idaho near Preston, and one a few miles above the mouth of the Bear. At the Idaho station the plankton were representative of a reasonably clean stream, with plant forms predominating. At the station near the mouth of the Bear, animal plankton predominated. This change was attributed to suspended solids that reduced the penetration of light which is essential to growth of plant plankton.

Two stations on the Cub River also were sampled for plankton during August, one in Idaho above sources of pollution, and one in Utah below the California Packing Company, at Franklin, Idaho, and below Worm Creek, carrying the sewage from Preston. Here again plant plankton predominated at the upstream station, while animal plankton and pollution-tolerant forms were found at the Utah station.

In November, collections were made at the Bear River station in Idaho, at one below the confluence of the Cub River with the Bear, and at one below Cutler Reservoir. The Idaho station again yielded plankton typical of an unpolluted stream. At both the downstream stations in Utah there were Sphaerotilus, or bacterial slime organisms, and zoogleal colonies typical of organic pollution.

November collections on the Cub River were at the same station used in August in Idaho, and at one station near the mouth of the Cub. Here again the Idaho station yielded principally plant forms, while the station near the mouth of the Cub yielded bacterial slime organisms, zoogleal colonies and pollution-tolerant protozoa. An attempt to collect plankton samples on the Cub River a short distance below the mouth of Worm Creek was unsuccessful because of a heavy concentration of beet pulp fragments.

An attempt at collection of plankton on Worm Creek near its mouth also was unsuccessful because of beet pulp fragments. At a station on Worm Creek below the entrance of Preston sewage, bacterial slime organisms and zoogleal colonies, typical of pollution, also were found.

BOTTOM FAUNA

On the Bear River in Idaho the bottom forms were normal for an unpolluted stream. Downstream in Utah, both below the mouth of the Cub River, and near the mouth of the Bear, productivity of bottom forms was quite low, numbers of species were small, and forms tolerant of pollution predominated. All of these factors are indicative of pollution.

Collections of bottom fauna on the Cub River above Franklin, Idaho, yielded results typical of an unpolluted stream. In both August and November, collections below the California Packing Company at Franklin, Idaho, indicated conditions of severe pollution. There were only two species, red midges and sludge worms, both typical of pollution. Heavy deposits of sludge supported large numbers of these bottom forms. Although the canning plant was closed in November, the sludge deposits remained to produce even larger numbers of these pollution indicators than were found in August.

Some effect of the California Packing Company pollution extended downstream in the Cub River to the station below the mouth of Worm Creek in Utah during August. Red midges and sludge worms were found, but other forms less tolerant of pollution also were present. "Pollutional blankets" of blue-green algae were abundant. In November at this station combined wastes from upstream, including those from the Franklin County and Amalgamated sugar plants, caused a severe reduction in bottom fauna, with only a few numbers of organisms found.

On Worm Creek above Preston in August there was practically no flow. In November, bottom organisms were plentiful, and were typical of a clean stream. In August, the collection at the station near the mouth of Worm Creek indicated heavy pollution due to Preston sewage and low stream flow, and possibly irrigation return flows. In spite of higher stream flow in November at this station, the added pollution from the Franklin County Sugar Company almost eliminated bottom life. A few sludge worms, which thrive in polluted water, were found.

FISH

Trout fishing is reported to be excellent in the Bear River from above Preston upstream to Oneida Dam in Idaho.

From Preston downstream to the mouth of the Bear River there are only a few trash fish such as carp and catfish, and even catfish have practically been eliminated since an extensive fish kill in November 1953. This kill was attributed to pollution from the Utah-Idaho Sugar Company on the Malad River, but failure of the fishery to recover is attributed to continuing pollution from the major sources, and to heavy siltation caused by irrigation practices in an area in Idaho west of Preston.

A fish population study in 1954 failed to detect any fish of any kind in the Bear River at a point 7 miles below the confluence of the Cub River. The same study produced only a few carp below Cutler Dam.

Trout fishing is mediocre in the Cub River above Franklin. Large minnow populations abound, which should support sport fishes. Probably excessive downstream pollution hinders upstream migration of sport fishes for spawning, which would maintain the sport fisheries in the upper reaches of the Cub River and Worm Creek.

IRRIGATION

The heavy siltation of the Bear River that resulted from irrigation practices in Idaho west of Preston has been mentioned previously. In areas drained by Five-Mile and Deep Creeks, irrigation raised the ground water table and caused seepage and sloughing of sandy soil from embankments. It has been estimated that in the 40 years previous to 1950, ten million tons of soil were washed into the Bear River from this source, and the bed of the Bear River has been silted almost uniformly with deposits 5 to 6 feet deep. Recent erosion control measures have achieved some success in reducing the severe erosion.

Mineral analyses included in the Utah Water Pollution Control Board study of July, 1958, through September, 1959, indicated Bear River water to be of questionable quality for some irrigation uses. At a station west of Lewiston, Utah, a few miles below the Idaho-Utah state line, and at the station west of Smithfield, below the confluence of the Cub River, mineral water quality indicated a high salinity hazard from late in March to late in September.

On the Cub River a few miles below the state line, and below the confluence of Worm Creek, the data during most of the same period indicated a medium salinity hazard. For a short portion of the time, during late July and early August, the salinity hazard was indicated to be high. On the Cub River just above its mouth, the salinity hazard was medium throughout the period.

The source of the minerals contributing to the salinity hazard of these waters is not known. The mineral constituents may originate in natural sources, or they may be introduced by upstream use of the water for irrigation, or by industrial waste discharges. Use of the water for irrigation is believed to be the most probable cause.

BEAR RIVER: EVANSTON, WYOMING TO WYOMING-UTAH BORDER

The Bear River is formed a few miles southeast of Evanston, Wyoming, by the junction of Sulfur and Mill Creeks. The river flows northwesterly to Evanston and continues northward for about 17 miles, where it turns abruptly westward to cross the Wyoming-Utah state line near Woodruff, Utah. The river travels an estimated 30 to 35 miles in this distance.

Evanston, with a sewered population of about 5,000, has a sewage treatment plant. The plant is equipped for chemical flocculation, sedimentation, chlorination, and sludge digestion and drying. At the time of a visit to the plant in November, 1959, the chemical flocculation and chlorination facilities were not in use. In addition, the Union Pacific Railroad Company shops at Evanston discharge wastes of unknown characteristics to the Bear River.

Samples for coliform bacteria determination have been collected from the Bear River above Evanston and near the Wyoming-Utah state line during several periods in the past 18 months. Periods during which samples were collected, and median MPN's for the periods, are presented in Table 3.

During two of the five periods the median coliform bacteria near the Wyoming-Utah state line were a little less than one-fifth of the standard for Class C waters.

A short distance below Evanston, the Chapman Canal diverts water for irrigation in Utah. This canal crosses the Wyoming-Utah state line about one-half of the distance from Evanston to the point where the Bear River crosses the state line. No samples for coliform bacteria have

TABLE 3

BEAR RIVER: WYOMING-UTAH
MEDIAN MPN'S OF COLIFORM BACTERIA
ABOVE AND BELOW EVANSTON, WYOMING

Period	Coliform Bacteria MPN per 100 ml.	
	Above Evanston	Near State Line
4/23/1959*	Less than 23	Less than 23
8/24-28/1959	-	43
9/14-18/1959	140	810
11/9-13/1959	-	430
4/21-28/1960	23	930

*Results questionable, samples in transit, uniced, for four days.

been collected from the canal, and therefore, its bacterial quality at this point is unknown. At an approximately equivalent point on the Bear River the median coliform bacteria were between 3,000 and 4,000 per 100 ml, which is below the standard for Class C waters.

Samples for mineral analyses were collected from this reach of the Bear River during April, August, and September, 1959. Above Evanston the salinity hazard was low. At the Wyoming-Utah state line the salinity hazard increased to high. As in the case of the Lower Bear River, the source of the added mineral constituents in this river reach is unknown.

MALAD RIVER: MALAD CITY, IDAHO TO GARLAND, UTAH

The only possible present source of interstate pollution on the Malad River appears to be Malad City, Idaho. This town, with 2,000 sewered population, provides primary treatment and chlorination for its sewage. Until such time as there may be a major increase in population or industry, or a failure in the treatment plant, it does not appear that pollution of interstate waters of the Malad River is occurring.

SUMMARY AND CONCLUSION

Pollution of interstate waters of the Bear and Cub Rivers, and of Worm Creek occurs in the vicinity of the Idaho-Utah state line. Sources of municipal and industrial wastes causing the pollution are Preston, Idaho, the Franklin County Sugar Company at Whitney, Idaho, and the California Packing Company at Franklin, Idaho. In addition, irrigation practices in Idaho have led to serious erosion and consequent siltation of the Bear River in Utah, and presumably have contributed to a high salinity hazard in the waters of the Bear and Cub Rivers.

The sources of wastes in Idaho, both separately, and in combination with wastes from Lewiston, Utah, and the Amalgamated Sugar Company at Lewiston, the Sego Milk Company at Richmond, Utah, and the Rocky Mountain Dairy Products Company, and the California Packing Company at Smithfield, Utah, have contributed to adverse effects on water quality and use, which extend from the Idaho-Utah state line on Worm Creek and Cub River to the mouths of these two streams, and on the Bear River downstream at least as far as Cutler Dam.

The adverse effects are reflected by high coliform bacteria, B.O.D., and suspended solids concentrations, by low D.O. concentrations, by poor to practically no biological flora and fauna, including fish, by high salinity hazard, and by objectionable visual and olfactory conditions.

These adverse conditions adversely affect the use of the water for recreation, including fishing, for irrigation and stock watering, and as a habitat for fish and wildlife.

Based on the foregoing information, it is concluded that pollution of interstate waters of Worm Creek and the Cub and Bear Rivers endangers the health and welfare of persons using these waters in Utah.